



**DEPARTMENT OF DEFENSE
PANEL TO REVIEW THE V-22 PROGRAM**
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February 14, 2001

Chairman
John R. Dailey

Panel Members
Norman R. Augustine
James B. Davis
Eugene E. Covert

Executive Secretary
Gary J. Gray

**Subject: Minutes of the Panel to Review the V-22 Program Meetings,
January 11-13, 2001**

On January 11-12, 2001, the Panel to Review the V-22 Program conducted fact finding sessions in Suite 940, 1235 Jefferson Davis Highway, Arlington, Virginia. Panel member attendees were: General John R. Dailey, USMC (Retired), Chairman; Mr. Norman R. Augustine; General James B. Davis, USAF (Retired); and Dr. Eugene E. Covert. Panel staff attendees were: Mr. Gary J. Gray, Executive Secretary; Colonel Rick Schwartz, USMC; Colonel Carl A. Steel, USAF; Mr. Bryan D. O'Connor (Consultant), Mr. Hector O. Nevarez, Ms. Carolyn F. Duke, and Mr. Doug Pang.

Mr. Gray opened the meeting and explained the purpose of the panel. Mr. Gray introduced the Chairman, panel members, and staff then turned the meeting over to the Chairman. The meeting continued with a series of briefings from the V-22 Program Manager, his staff, contractors, test team members, and others. Attachment 1, "Agenda, Briefers, and Attendees," lists the briefers and the subject of their briefings. Attachment 2, "Briefing Summaries," provides accurate summaries of the briefings presented to the Panel.

During the course of the meetings, requirements for additional data were identified. The Panel members discussed the presentations with the briefers and developed a series of requests for additional information. The Panel discussed these requests throughout the briefing. Attachment 3, "Information Requests," lists the information requested. These information requests have already been separately tasked.

On January 13, the panel members: General Dailey, Mr. Augustine, General Davis and Dr. Covert, and panel staff: Mr. Gray, Colonel Schwartz, Colonel Steel, Mr. O'Connor, and Mr. Nevarez met to discuss additional data requirements and tentative travel plans.



J/R Dailey

Attachments:

Attachment 1 - Final Agenda, Briefers, and Attendees

Attachment 2 - Briefing Summaries

Attachment 3 - Information Requests

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Information Briefing 11 January 2001

Time	Briefing	Briefer
0800-0850	Deputy Commandant for USMC Aviation	LtGen McCorkle
0900-0950	DOD General Counsel (FACA/Privileged Information)	Mr. Aly and Mr. Schanzer
1000-1025	CV-22 Requirements Brief	LtCol Lemaster
1025-1050	MV-22 Requirements Brief	LtCol Wick
1100-1130	V-22 Program Overview	Col Schmidt
1130-1150	V-22 Design Overview	Maj Manzer
1200-1300	Lunch	
1300-1340	EMD Test Overview Pre-OPEVAL through OPEVAL	Mr. Dunford
1340-1350	EMD Test Overview OPEVAL through Post-OPEVAL	Majors Ryan and Currie
1400-1430	Vortex Ring State	Mr. McCue
1430-1450	Status of HROD Testing	Mr. MacDonald
1500-1520	Reliability & Maintainability Growth/Implementation Plan	Cdr. Schwartzberg
1520-1535	Quality	Ms. Bose
1535-1550	Training	LtCol Fancher
1600-1650	Discussion with V-22 Integrated Test Team Pilots	Ryan/MacDonald

Information Briefing 12 January 2001

Time	Briefing	Briefer
0800-0830	Funding	Ms. Harrison
0830-0850	V-22 Summary	Col Schmidt
0900-0950	OPEVAL (COMOPTEVFOR)	LtCol Salzman
1000-1050	DOT&E (Beyond LRIP Report)	Mr. Coyle
1100-1120	Milestone III Decision Process	Dr. Buchanan
1120-1150	DOT&E	Mr. Coyle
1200-1230	DOT&E	Mr. Coyle
1230-1330	Lunch	
1330-1420	Naval Safety Center (Mishap Briefs)	RAdm. Dirren
1430-1620	GAO Brief	Ms. Schinasi
1620-1700	OSD PA&E	LtCol Samples

AGENDA, BRIEFERS, AND ATTENDEES

FOR THE SECDEF BLUE RIBBON PANEL

Information Briefing—January 11, 2001

<u>Time</u>	<u>Briefing</u>	<u>Briefer</u>	<u>NAVAIR/Briefer Attendees</u>	<u>Other Attendees</u>
0800-0850	Deputy Commandant for USMC Aviation	LtGen McCorkle	Ms Stelloh-Garner, Col Schmidt	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue BG Comer, Col Bamberger
0900-0950	DOD General Council (FACA/Privileged Information)	Mr. Aly	Ms Stelloh-Garner, Col Schmidt	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, BG Comer, Col Bamberger
1000-1025	MV-22 Requirements Brief	LtCol Wick	Ms Stelloh-Garner, Col Schmidt	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, BG Comer, Col Bamberger
1025-1050	CV-22 Requirements Brief	LtCol Lemaster	Ms Stelloh-Garner, Col Schmidt	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, BG Comer, Col Bamberger
1100-1130	V-22 Program Overview	Col Schmidt	Ms Stelloh-Garner, Cdr Schwartzburg, LtCol Ingram, Mr Miller, Maj Manzer	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue,
1130-1150	V-22 Design Overview	Maj Manzer	Ms Stelloh-Garner, Col Schmidt, Cdr Schwartzburg, LtCol Ingram, Mr Miller	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue
1200-1300	Lunch			
1300-1340	EMD Test Overview Pre-OPEVAL through OPEVAL	Mr. Dunford	Ms Stelloh-Garner, Col Schmidt, Cdr Schwartzburg, LtCol Ingram, Mr Miller	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, Saltzman, Bianca, Hershberger, Renner
1340-1350	EMD Test Overview OPEVAL through Post-OPEVAL	Maj Ryan Maj Currie	Ms Stelloh-Garner, Col Schmidt, Cdr Schwartzburg, LtCol Ingram, Mr Miller	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, Saltzman, Bianca, Hershberger, Renner
1400-1450	Vortex Ring State, Status of HROD Testing	Mr. McCue, Mr. MacDonald	Ms Stelloh-Garner, Col Schmidt, Cdr Schwartzburg,	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, Saltzman,

1500-1520	Reliability & Maintainability Growth/Implementation Plan	Cdr Schwartzenburg	LtCol Ingram, Mr Miller	Bianca, Hershberger, Renner
1520-1535	Quality	Ms. Bose	Ms Stelloh-Garner, Col Schmidt, Cdr Schwartzenburg, LtCol Ingram, Mr Miller	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, Saltzman, Bianca, Hershberger, Renner
1535-1550	Training	LtCol Fancher	Ms Stelloh-Garner, Col Schmidt, Cdr Schwartzenburg, LtCol Ingram, Mr Miller	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, Saltzman, Bianca, Hershberger, Renner
1600-1650	Discussion with V-22 Integrated Test Team Pilots	Maj Ryan Mr. MacDonald	Ms Stelloh-Garner, Col Schmidt, Cdr Schwartzenburg, LtCol Ingram, Mr Miller	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, Saltzman, Bianca, Hershberger, Renner

Information Briefing—January 12, 2001

<u>Time</u>	<u>Briefing</u>	<u>Briefer</u>	<u>NAVAIR/Briefer Attendees</u>	
0800-0830	Funding	Ms. Harrison	Rdml Enewold, Col Schmidt, Cdr Schwartzburg, LtCol Ingram, Mr Miller	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue
0830-0850	V-22 Summary	Col Schmidt	Rdml Enewold, LtCol Ingram, Cdr Schwartzburg, Mr Miller	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue
0900-0950	OPEVAL (COMOPTEVFOR)	LtCol Salzman	Cdr Schwartzburg, LtCol Ingram, Mr Miller	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, Saltzman, Bianca, Hershberger, Renner
1000-1050	DOT&E (Beyond LRIP Report)	Mr. Coyle	Mr McKeown, Cdr Schwartzburg, LtCol Ingram, Mr Miller, Maj Ryan, Mr MacDonald	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, Saltzman, Bianca, Hershberger, Renner, Gary Comfort, Rex Rivolo, Brent Crabtree
1100-1120	Milestone III Decision Process	Dr. Buchanan		Mr. Phillip Coyle, Capt Butler
1100-1150	DOT&E	Mr. Coyle	Mr McKeown, Cdr Schwartzburg, LtCol Ingram, Mr Miller, Maj Ryan, Mr MacDonald	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, Saltzman, Bianca, Hershberger, Renner, Gary Comfort, Rex Rivolo, Brent Crabtree
1200-1230	DOT&E	Mr. Coyle	Mr McKeown, Cdr Schwartzburg, LtCol Ingram, Mr Miller, Maj Ryan, Mr MacDonald	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, Saltzman, Bianca, Hershberger, Renner, Gary Comfort, Rex Rivolo, Brent Crabtree
1230-1330	Lunch			
1330-1420	Naval Safety Center (Mishap Briefs)	Radm. Dirren	Cdr Schwartzburg, LtCol Ingram, Mr Miller	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue
1430-1620	GAO Brief	Ms. Schinasi	Cdr Schwartzburg, LtCol Ingram, Mr Miller, Mr. Schwartz	Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue, Saltzman, Bianca, Hershberger,

1620-1700	OSD Program Analysis and Evaluation Brief	LTCol Dave Samples	Cdr Schwartzenburg, LtCol Ingram, Mr Miller	Renner
				Mr. Phillip Coyle, Tom Carter, Col Dan Schultz, LTCOL Logue

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BRIEFING SUMMARIES

11 JANUARY 2001

Marine Corps Overview: LtGen McCorkle, USMC, Deputy Commandant for Aviation

General McCorkle gave the Marine Corps perspective on the MV-22, stressing the age of the current fleet of CH-46E and CH-53D helicopters and the Marine Corps' need for power projection from the sea. He also commented on the status of the Mirana mishap investigation and implications on further testing.

DOD General Counsel Federal Advisory Committee Act (FACA) and Privileged Information: Mr. Aly and Mr. Schanzer

The DOD General Counsel representative briefed the Panel on the Federal Advisory Committee Act, including the procedures for open meetings and recordkeeping. Mr. Aly described draft procedures for handling privileged information. The point of contact for the Panel is David Shanzer.

CV-22 Requirements: Lt Col Lemaster, HQ Air Force Special Operations Command XP

Colonel Lemaster's briefing included a discussion of CV-22 differences and the mission of high speed, long range vertical take-off and landing (VTOL) aircraft capable of mission accomplishment in a single period of darkness. The 1994 Cost and Operational Effectiveness Analysis (COEA) identified the CV-22 as the only alternative that substantially meets the special operations forces (SOF) need, and the SOF has already begun downsizing their current fleet of helicopters and C-130s to provide resources for CV-22. Planned Initial Operational Capability (IOC) is Fiscal Year 2005 with Full Operational Capability (FOC) of 50 aircraft in Fiscal Year 2012.

MV-22 Requirements: LtCol Wick, HMC Aviation APP

Colonel Wick discussed the top level USMC requirements, the current medium lift force structure, and how the MV-22 is expected to enable the Service's Operational Maneuver from the Sea concept. He gave examples of how the speed and range of the MV-22 should improve the USMC capability in several global scenarios.

V-22 Program Overview: Col Schmidt, PMA-275

The Program Manager discussed the program's history (beginning with Milestone-0 in 1981 and including production termination in the early 1990s). He described the MV-22 acquisition management approach and organizational approach at NAVAIR and the contractor (Bell Boeing). He listed the Key Performance Parameters, and referred to the program's 200 plus "threshold" requirements.

V-22 Design Overview: Maj Manzer, PMA-275, Systems Engineering

The Deputy Assistant Program Manager System Engineering discussed the history of requirements, and the design of the MV-22. The briefing included the design concept for all major systems and differences between the full-scale development (FSD) and engineering and manufacturing development (EMD) aircraft.

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EMD Test Overview Pre-Operational Evaluation (OPEVAL) through OPEVAL: Mr. Dunford

The Bell Boeing Test team manager discussed the integrated test concept, and the history of EMD testing with emphasis on process and schedule performance.

EMD Test Overview OPEVAL through Post-OPEVAL: Major(s) Ryan and Currie, Integrated Test Team

The Integrated Test Team leads for MV-22 and CV-22 described the scope of EMD tests including those deferred from OPEVAL and the high rate of descent (HROD) testing resulting from the Mirana mishap. They laid out the upcoming CV-22 flight test schedule and how it has been delayed by recent events.

Vortex Ring State: Mr. McCue, US Naval Test Pilot School

Mr. McCue gave a detailed description of the theory of Vortex Ring State (VRS). He said the engineering community understands the phenomenon, pointing out that it happens in all helicopters, and described the MV-22 unique roll-off phenomenon. The test team has since replicated some of the lateral directional characteristics of the MV-22 during VRS.

Status of HROD Testing: Mr. MacDonald, Bell Boeing V-22 Chief Test Pilot

The Bell Boeing test pilot described the High Rate Of Descent (HROD) test plan, and discussed with Mr. McCue the results of the test program to date, as well as the implications on future Naval Air Training and Operating Procedures Standardization (NATOPS) manual limitations aircraft warning systems.

Reliability and Maintainability Growth/Implementation Plan: Commander Schwartzberg, PMA-275 Systems Engineering

Commander Schwartzberg discussed the reliability requirements, including the differences in measured parameters with other programs (mean time between failure (MTBF) versus mean flight hours between failures (MFHBF)). He pointed out that during the Operational Test and Evaluation, reliability, measured in terms of mean flight hours between failures (MFHBF), demonstrated 0.7 MFHBF vice an Operational Requirements Document threshold requirement of 1.4 hours MTBF. The program manager described how that this approach increased the standard of measure by about 30 percent since MTBF includes an additional 30 percent of operation time on any sortie. The plan shows the system meeting the MTBF requirement by late 2003.

Quality: Ms. Bose, PMA-275 Quality Assurance

Ms. Bose pointed out how efforts throughout EMD have effectively improved aircraft quality. However, as the program transitioned to Low Rate Initial Production, a significant number of defects were identified. As a result, the program manager asked for a review and the findings, and recommendations are in progress.

Training: LtCol Fancher, PMA-275 Training

Colonel Fancher described the state-of-the-art pilot simulator currently being used to train pilots who are transitioning to the V-22. The current support concept shows

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software updates going to the airplanes first and the simulator last. On the subject of maintenance training, a subcontractor problem caused a delay in the maintenance trainer, and the Bell Boeing alternative proposal was too expensive (\$130 million), so the Program Manager has added an additional MV-22 aircraft to serve as a maintenance trainer.

Discussion with V-22 Integrated Test Team Pilots: Majors Ryan, Currie and Mr. MacDonald

The test pilots discussed the flight test programs, and spoke in detail about the HROD test program. They said they are comfortable with the progress of HROD testing and the handling quality upgrades following developmental test.

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BRIEFING SUMMARIES

12 JANUARY 2001

Funding: Ms. Harrison, PMA-275 Business Manager

The Program Business Manager discussed the history and projections for total program cost. To date, sunk costs are \$12 billion, with a majority of RDT&E completed, and \$29 billion remaining to completion. She talked about the history of program cost changes, and V-22 cost and schedule performance indicators. She pointed out that program execution through August 2000 has been successful as evidenced by schedule and cost performance indices of 99 percent.

OPEVAL COMMANDER, OPERATIONAL TEST AND EVALUATION
FORCE (COMOPTEVFOR): Major Bianca HMX-1

The HMX-1 MV-22 Operational Test Director discussed the OPEVAL including waivers limitations, and findings. Conclusions of the test team were that the MV-22 is operationally effective and suitable. Most performance parameters were met, but some reliability and maintainability measurements did not meet requirements.

Assistant Secretary of the Navy for Research, Development and Acquisition:
Dr. Buchanan

Dr. Buchanan briefly discussed the Milestone III decision process and stressed that the recently deferred Milestone decision was not based on a safety concern, but rather on reliability issues as they affect aircraft availability.

DOT&E (Beyond Low Rate Initial Production Report): Mr. Coyle Director,
Operational Test and Evaluation

Mr. Coyle gave a thorough presentation of the results of the OPEVAL as analyzed by the DOT&E. He discussed waivers and limitations, and results of the tests ashore and afloat. He also discussed the Mirana mishap and DOT&E assessment of VRS. He summarized that while the V-22 provides many operational advantages over existing aircraft, reliability and maintainability have not met required levels, a matter that could, in his opinion, have life cycle and safety implications. He also suggested the need for further testing and research to characterize VRS as well as autorotation, downwash, uncommanded roll and emergency egress from fully loaded aircraft. In conclusion, his assessment was that beyond low rate initial production, the aircraft, as tested, is "effective, but not suitable."

Naval Safety Center (Mishaps): RADM Dirren, Commander, Naval Safety Center
The Commander of the Naval Safety Center briefed the V-22 mishaps.

GAO: Ms. Schinasi, Government Accounting Office

The GAO team discussed their plans for data gathering in support of a self-initiated assessment of the V-22 program. They expressed their concerns with the program and their interest in coordinating with the Program Office and the Panel as they go forward.

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OSD (PA&E): LtCol Dave Samples, OSD

Colonel Samples presented a summary of the 1994 Cost and Operational Effectiveness Analysis that was the basis for the Milestone II review that supported continuation of the integrated MV-22/CV-22 program in 1995.

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INFORMATION REQUESTS

NOTE: *It is anticipated that the Program Manager will provide the information requested except where other responsible organizations are noted in bold italics. The panel will require the information requested in writing and electronically by January 31, 2001.*

Requirements and Operational Effectiveness

- **Program Manager, Joint Staff, and DOT&E** will work together on a matrix that:
 - Identifies all requirements (key performance parameters, Joint Operational Requirements Document threshold requirements, and Service unique) and the status in terms of requirement satisfied, not met or waived.
 - Reflects the Program Manager's corrective actions ongoing or planned to address the stated deficiencies, and projected date for satisfying the requirement
 - Summarizes the current respective positions into areas of agreement, disagreement and unresolved
 - Where possible, correlate the assessments with the stated requirements
 - Position papers (1 page maximum) will be prepared identifying program related issues that fall outside of the stated requirements.
 - Position papers (1 page maximum) will be prepared where there are areas of disagreement or requirements that are currently unresolved.
- Provide a current assessment of the V-22's capabilities compared to other alternatives including the overall support infrastructure. (**OSD PA&E, Joint Staff, Marine Corps, Special Operations Command to work with V-22 Panel DoD Staff members**)
- SOCOM ground commanders' concerns with CV-22 (i.e., equipment transport capability)
- Status of downwash issues, if any, on flight decks and shore based landing facilities including troop transport mission (fastrope)
- Status of Nuclear, Biological, and Chemical Requirements
- Status of hoist capability

Safety—Mishap History and Comparisons to Other Aircraft

- V-22 mishap reports (all classes): **Naval Safety Center (NAVSAFCE)**
- Mishap rates for early years of selected other types (fixed and rotary wing): Include AV-8A, CH-53E, CH-46, U/MH-47, UH-60, F-14, F-4, F-16 and

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F-18. XV-15 should be included but note that it was not characteristic of development or production aircraft since it was operated by the contractor and flown by test pilots. (*NAVSAFECEN*)

- Failure Mode Effects and Criticality Analysis (FMECA), Hazard Reports and Safety Analysis Reports: (*Naval Air Systems Command, Safety, Reliability & Quality Assurance*)

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INFORMATION REQUESTS (Continued)

Training

- Naval Air Training and Operating Procedures Standardization (NATOPS) pilot manual (including pre-accident Vortex Ring State warning)

Engineering and Design

- Configuration differences: Full Scale Development vs. Engineering and Manufacturing Development (EMD) (including power train)
- Acoustic signature data on V-22 vs. other helicopters
- Engine testing vs. other similar engine test programs
- Flight test hours vs. other aircraft development programs
- EMD test results (Pareto chart)
- Swash plate functional and design description

Production and Quality Control

- Quality data (by tail number)

Reliability (Suitability)

- Top 10 reliability detractors
- Status of health monitoring for the engine
- Weapon system reliability data (CV-22 briefing)
- List of all EMD engine failures (pre-qualification and qualification)
- Full mission capable top drivers and plan to address
- V-22 swash plate history (incl. actuators)
- Failure rate analysis (is failure rate decreasing)

Programmatic

- Selected Acquisition Report (including pre-EMD SAR)
- Funding profile by year showing aircraft quantities and funding level included in the Fiscal Year 2002-2007 President's Budget
- Flyaway unit cost of last production aircraft in 2001 dollars
- Latest flight clearance/restrictions
- Learning curve experience to date
- Bell Boeing Joint Program Office (JPO) Management Plan and Systems Engineering Plan
- General Accounting Office (GAO) Best Practice Reports and 1997 V-22 Report: *(GAO)*